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lotus follicularis. With regard to the morphology of the parts of the leaf of *Nepenthes*, he comes to the conclusion that in this well known genus "we have to deal with a leaf the lamina of which is interrupted in the middle of its course by becoming reduced to its midrib, and that while the proximal portion of the lamina retains its typical form of a flat expansion, the distal portion becomes peltately expanded into a funnel or pitcher."

AS WE ARE going to press Dr. Farlow's monograph on New England Algæ comes to hand. As it is so late in the season he distributes them without binding. As soon as copies can be bound they will be on sale at the Naturalist's Bureau, Salem, Mass. An artificial key makes it of use even to those who have no intimate knowledge of the structure of Algæ. Every person on the sea shore this summer, who is at all scientifically inclined, should have a copy of this monograph.

Home and Foreign Modes of Teaching Botany. III.—

Though somewhat out of the usual order for a botanical journal to discuss modes of teaching, I offer the following, on the simple ground that the time appears to be ripe for it. Until within the last ten years botany in the United States has been with the many students and with most of the teachers a mere science of nomenclature, hardly rising to the dignity of true systematic study. This doubtless arises from two causes: first, because of want of means to enter upon other fields of work in the vegetable kingdom; and second, because the mass of students simply caught the enthusiasm of the great teachers whose energies were bent upon reducing to some respectable order the vegetable cohorts of the land, though the former for want of time were unable to reach the inspiration which was founded upon the deepest insight into the anatomy and physiology of plants. Even this measure of attainment is commendable and has at least led to the capacity for discovering what others have to say about any given plant, and so paved the way for the more thorough modes of these coming years. We are commencing to feel that even without a name a plant may teach us much that is worth knowing, to which knowledge it is all the better that we shall add the name as well.

How shall we teach botany then that it may meet modern wants, and associate itself properly with its biological ideas which are now doing so much to shape modern mental culture?

Our best appeal here is to the facts, and I believe I am safe in saying that the whole, or nearly the whole American impulse in botany owes its origin, directly or indirectly, to Cambridge. Certainly it has been a prolific teacher of teachers; so prolific that we may well ask its methods. These may be summed up in the one sentence: *The teacher will keep you on the track, but you must find out for yourself.*

The same fundamental idea characterizes the celebrated laboratories of Germany, and notably, the oldest and probably the most productive one, that of Prof. deBary. One essential difference obtains however between the American and German laboratories; we give

systematic, they anatomical and physiological botany greater attention. Herein I am persuaded they are correct. I believe I am safe in saying that a man might there successfully pass his examination for the degree of Doctor of Philosophy and yet not be able to name "on sight" three hundred species of plants; but he has the training which enables him to determine all, when there exists a necessity for doing so. We on the contrary insist on the recognition of plants, without inquiring too critically how much the candidate knows about them.

Systematic botany must, if it represents a strictly natural system, be founded on a nice appreciation of the entire organization, the life history of the individual, and its relation in present and past time to allied plants. This then is the highest, all embracing trend botanical thought can assume. In aspiring to this we neglect the foundation. The German school builds a solid foundation and leaves the student mainly to give the superstructure such shape as he will. Between the two there can be but little doubt as to which is the more philosophic, or certainly as to which is the better mode of training for original investigation.

The laboratories of Harvard, Michigan (two) and Iowa have taken the initiative in introducing needed reforms, and already a most promising crop of fruit is the result. The labors of Torrey, Gray, Engelmann and Watson have placed our phænogamic flora on firm foundation for subsequent workers, and the question now is how are these to be trained? First of all, by indoctrinating them with the idea that they will make the most substantial mental gains if they study each individual plant exhaustively. How far this shall be carried is a question for the judgment of the teacher, but it is the idea the student should be saturated with "through and through." It is the foundation of his foundation, and makes critical investigation press upon him with the weight of an ever present duty. Yet this is just the hardest lesson every American teacher finds it to inculcate. Does it indicate a radical defect in the earlier culture, or is it a race peculiarity?

Another idea in this connection is worthy the consideration of teachers, *i. e.*, that take any plant, its life history is but imperfectly known, and the student may be encouraged to believe that he can in it find something hitherto unknown, if he will but hunt for it. The readiest possible confirmation of the absolute truth of this statement is found in that noble series of works Mr. Darwin has given the world. So valuable have they been that hardly a branch of natural science has failed to acknowledge their influence. Yet how few plants have been treated upon by them! This is essentially the idea upon which de Bary's instruction is predicated, and witness the discoveries, among the commonest plants, that have followed his systematic questioning point by point the life history of each one.

Apart from this honest study of one very narrow field, the lectures of the professor are not to be regarded as points confirmed for the special benefit of the student to save labor on his part, but rather as outlines of the facts the student must verify. The value of such training, embracing as it does a survey of the large part of the field

cannot be overestimated. With us the teacher does the asserting in his own, or other authority, the pupil simply accepts, and that ends it until examination day. But what critical scholarship, what mature judgment, has been, or can be formed by such a process?

No botanical laboratory is worth the name which does not include in its outfit a good working compound microscope, along with chemicals for each student, and type specimens, and a modern set of standard botanical works of reference which should be freely used. No botanical course, consisting of lectures exclusively can rise to the dignity of being contemptible, if its object is to make botanists or to even give a certificate of botanical proficiency. There is no biological laboratory of England where students investigate more critically the teachings of the chair than in that of Prof Huxley, nor, on the other hand is there any one which is producing now and promises in the future to produce a greater impression on the thought of the age. I conclude then that the time has fairly come for a change in our modes of teaching, and until we do adopt the methods of work which are now so universally followed abroad, we may expect to see an annual exodus of our most aspiring students to foreign seats of learning. Instead of concealing how much we lack of the true standard, the friends of liberal, practical, botanical education can do no more effective work than by agitating the subject until the remedy is furnished. There is yet one more aspect in which we may view this question. Popular ideas connect botany only with *flowers*. It is proper for us to insist that it produces *fruit* as well, that no science is more intimately associated with our food, drink, raiment and medicine than this. The public mind should be informed that it takes cognizance of practical forestry, of the diseases of our cereal grains, and indicates what we are to do in these directions.

That the impression should have prevailed so long that botanical study brings nothing of utility with it is largely our own fault. It is just what we have made it. When we work these needed reforms and show the public that we are in earnest, we may expect to see our science properly represented in every college of the land, but not before.—J. T. ROTHROCK.

Some Additions to the North American Flora, by Dr. G. Engelmann.—*ESCHSCHOLTZIA CALIFORNICA*.—The different forms of this common and extremely variable plant deserve to be studied more carefully at their homes, where they are found in such untold abundance. It is quite possible, as indicated in the Flora of California, that the several species into which it had been divided, may be sustained by reliable characters. All the forms, however, are said to be annuals with colorless juice. Now, on the sandhills of the ocean, quite close to the well-known Cliff-house near San Francisco, I found last October a form with long perennial roots, $\frac{1}{2}$ inch thick, abounding in orange-colored juice, and bearing several stems; leaves shorter than the internodes, often opposite, flowers 1 inch wide; torus broadly margined, capsule about 2 inches long, seeds reticulated. In most